MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2022/2023 (TERM ID 2210)

ECE3076 – DATABASE SYSTEMS

(All Section / Groups)

15 FEBRUARY 2023
9.00 A.M. – 11.00 A.M
(2 Hours)

INSTRUCTION TO STUDENTS

1. This examination paper consists of five (5) printed pages including cover page containing four (4) questions only.

2. Answer all questions. All questions carry equal marks (25 marks each) and the distribution of marks for each sub-question is given. The total for this paper is 100 marks.

3. Please write all your answers in the Answer Booklet provided.

Question 1

The following tables form a simple relational database used for tracking customer orders in an online shopping system. The bolded name represents the table name, and the attributes are listed beside it. The primary key for each table is indicated by the symbol (PK).

Categories: CategoriesID (PK), CategoryName, Description
Customers: CustomersID (PK), CustomerName, Contact, Address, City, PostalCode, Country
Employees: EmployeeID (PK), LastName, FirstName, Birthdate, Photo, Notes
Order_Details: OrderDetailID (PK), OrderID, ProductID, Quantity
Orders: OrderID, CustomerID (PK), EmployeeID, Date, Shipper ID
Products: ProductID (PK), ProductName, SupplierID, CategoryID, Unit, Price
Shippers: ShipperID (PK), ShipperName, Phone
Suppliers: SupplierID (PK), SupplierName, Contact, Address, City, PostalCode, Country, Phone

The Categories table stores the category of each product. When the customer completes a purchase, a specific order is created and the record is stored in Orders table. The order contains one or more order details stored in Order_Details table and this provides description of the product ordered. Each employee handles multiple orders. Product that is sold can appear in multiple order details. Each product is supplied by one supplier and a supplier can supply many products. Write a single SQL statement that satisfies the following request.

a) List all details of all customers from Germany.
[3 Marks]

b) Show the customer's name for all the orders.
[3 Marks]

c) Find out how many products are there in the database.
[3 Marks]

d) Find out the average price of a product.
[3 Marks]

e) Find out the number of distinct customers who have made purchases after 30th July 1996.
[4 Marks]

f) List the price and product sold by supplier 'Tokyo Traders'.
[4 Marks]

g) Use INNER JOIN to show the product name and cumulative total number of the product ordered as shown in the table **Order_Details**. [5 Marks]

Question 2

You have been hired to design a database system for the online shopping system described in Question 1. The database allows the company to track the orders made by different customers. Each order is shipped by a single shipper. All the tables must be represented.

a) Draw the Entity Relationship (ER) diagram for the database based on the tables and rules stated in Question 1. You must indicate the connectivity information in your diagram. Use the Crow's Foot ER diagram. Only primary key and foreign key need to be shown in the ER diagram.

[21 marks]

b) Assume that a supplier can supply many products and the same product can be provided by many suppliers. Resolve the many-to-many relationships found in this case. Draw the ER diagrams for the proposed solution. Label the primary and foreign key.

[4 marks]

Continued...

Question 3

a) Table 3.1 and Table 3.2 represent the relations **Employee** and **Department** respectively. The corresponding **primary key** of each table is bold and underlined.

Emp_ID	**Emp_Name**	**Dept_ID**
1	Cindy Khoo	NULL
1	Nelson Tan	A
2	Ahmad Rahman	D
3	Muthusamy	E
4	Mahmoud Sayid	D
5	Paul Dickson	NULL

Table 3.1: Employee

Dept_ID	**Dept_Name**
A	Accounting
B	IT
C	Facilities
D	Legal

Table 3.2: Department

i) Explain if entity integrity is satisfied in Table 3.1 [3 marks]

ii) Explain if entity integrity is satisfied in Table 3.2 [3 marks]

iii) Does the relationship between Table 3.1 and Table 3.2 satisfy referential integrity? Explain your answer. [3 marks]

b) You are given the following `Table X` with the primary keys underlined.
`Table X (ColA,ColB,ColC,ColD,ColE,ColF,ColG,ColH)`
The functional dependency between the attributes are stated as follow.
[Example: `Col1->Col2` indicates that `Col2`'s values are determined by `Col1`.]

- `ColA->ColB,ColC`
- `ColE->ColD,`
- `ColG->ColH,`
- `ColA,ColE->ColF,ColG`

i) Draw the dependency diagram for `Table X` with the corresponding partial and transitive dependencies identified correctly. [6 marks]

ii) Show the steps to normalize `Table X` to Second Normal Form (2NF). The new tables should be labeled with the numerical order for the names of the new table created by this step, i.e. `Table 2`, `Table 3` etc. [6 marks]

iii) Normalize the solution of part (b)(ii) to Third Normal Form (3NF). The new tables must be shown. [4 marks]

Question 4

a) The table below represents a situation with numerous transactions from various users, as well as the data objects locked and required by each transaction.

Transaction	Data Items Locked	Data Items Required
T1	X8,X10,X15	X2,X3,X20
T2	X1, X18, X20	-
T3	X13,X17	-
T4	X4,X5,X6	X12,X15,X17
T5	X14,X16	-
T6	X2, X11,X12	X1,X6, X17
T7	X9,X19	X11,X12,X14
T8	X3,X7, X14	X18

Draw the wait-for graph and label any transactions that are creating deadlock.

[15 marks]

b) In the **wound/wait** scheme, an older transaction rolls back the younger transaction and releases its resources. The younger transaction is rescheduled using the same timestamp and waits for the locks to be released.

Given the following scenario where T1 holds resources X1 and X2 while T2 holds resources X3 and X4. T1 needs X4 to complete while T2 needs X1 to complete. Assume T1 is the older transaction and makes the request first for X4.

Describe how the wound/wait scheme is used to overcome the deadlock in 5 steps. Include details of the resources being held and released at each step in your description.

[10 marks]

End of paper